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IDENTIFIERS *Vocational Education Readiness Test

ABSTRACT

Focusing on plumbing, this module is one of eight included in the Vocational Education Readiness Test (VERT). The module begins by listing the objectives of the module and describing tools and equipment needed. The remainder of the module contains sections on manipulative skills, trade vocabulary, tool identification, trade computational skills, and measuring skills depicted as minimum competencies students should possess prior to entrance into regular secondary vocational education programs. (A user's guide is also available--see note.) (LRA)

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Module 6 of the Vocational Education Readiness Test (VERT)

PLUMBING

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PLUMBING

Objective(s):

1. To determine the student's ability to measure with a 12" rule.
2. To determine student's ability to use ¾" to ½" pipe reducers in combination with ¾" plugs and ½" nipples.
3. To determine student's ability to use ½" elbows and ½" plugs, nipples, and caps.
4. To determine student's ability to use ½" unions with ½" nipples
5. To determine student's ability to use 10" and 14" pipe wrenches.
6. To determine student's ability to assemble plumbing components as depicted in a diagram.
7. To determine student's ability to cut ⅜" copper tubing with a tubing cutter.
8. To determine student's ability to flare ⅜" copper tubing with a flaring tool.
9. To determine student's ability to use brass fittings and adjustable wrenches with flared copper tubing.
10. To determine student's ability to assemble PVC piping components.

Tools Needed:

- 45° flaring tool
- Tubing cutter
- One coil of ⅜" copper tubing
- 6" adjustable wrench
- 8" adjustable wrench
- Assortment of brass fittings
- One ½" coupling (PVC)
- One can of PVC pipe cleaner
- One can of PVC pipe cement
- One Hacksaw for cutting PVC pipe
- 12" plastic ruler

Tools and Plumbing Components Needed:

- One 10" pipe wrench
- One 14 pipe wrench
- Three ¾" plugs
- Five ½" unions
- Two ½" tees
- Five ½" elbows
- Five ½" caps
- Three ½" plugs
- Three ¾" to ½" reducers
- One ½" to 1¼" nipples
- One ½" × 1½" nipples
- Three ½" × 2" nipples
- Two ½" × 2½" nipples
- Six ½" × 3" nipples
- One ½" × 3½" nipples
- Three ½" × 4" nipples
- One ½" × 4½" nipples
- Five ½" × 5" nipples
- Three ½" × 5" nipples
- Three ½" × 12" nipples

Preliminary Exercise:

The evaluator will identify a 12" plastic rule and demonstrate how to measure to the nearest inch, half-inch, quarter-inch, and eighth-inch. Answer any questions at this time; however, avoid *"teaching"* the student to measure by giving repeated demonstrations. (See Figure 1.)

Special Instructions: Lines for Tasks 1 - 4 should measure 3", 3 1/2", 3 1/4", and 3 1/8", respectively, and should be drawn on a separate sheet of paper.

Figure 1.

Task 1: _____*

Task 2: _____*

Task 3: _____*

Task 4: _____*

Tasks 1 through 4

Given a 12" plastic rule and measuring tasks 1, 2, 3, and 4, the student will measure the line in each task and tell his/her findings to the evaluator.

*Lines are drawn on separate sheet to respective length by evaluator.

Preliminary Exercise:

The evaluator will demonstrate how to use ¾" reducers in combination with ¾" plugs and ½" × 4" nipples. (See Figure 2.)

Special Instructions: Have like components grouped together for task #5, i.e. reducers, nipples, and plugs in separate but adjacent groups.

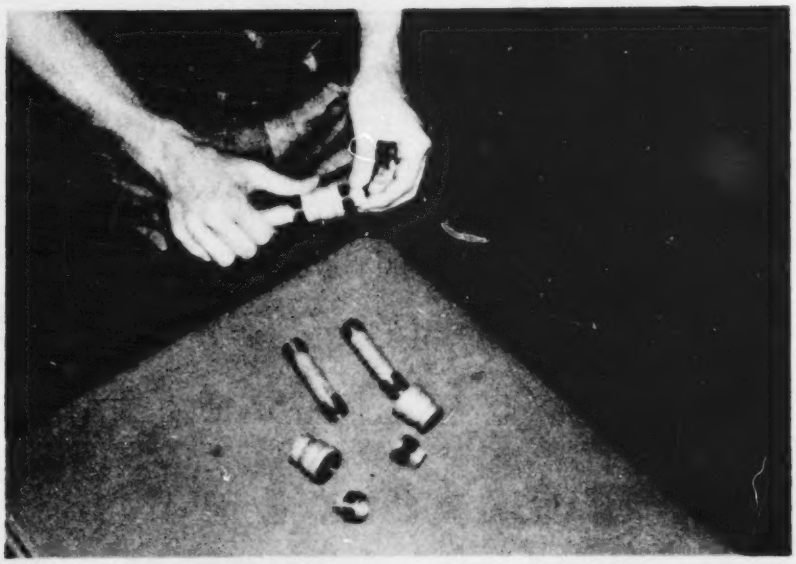


Figure 2.

Task 5

Given three each of ¾" reducers and plugs, ½" × 4" nipples, the student will assemble three duplicates of the pipe assembly which was assembled by the evaluator. **Note time!**

Preliminary Exercise:

The evaluator will demonstrate the use of ½" elbows in combination with ½" plugs, ½" × 5" nipples, and caps. (See Figure 3.)

Special Instructions: *Have like components grouped together for task #6 i.e., elbows, plugs, nipples, and caps should be placed in separate but adjacent groups.*

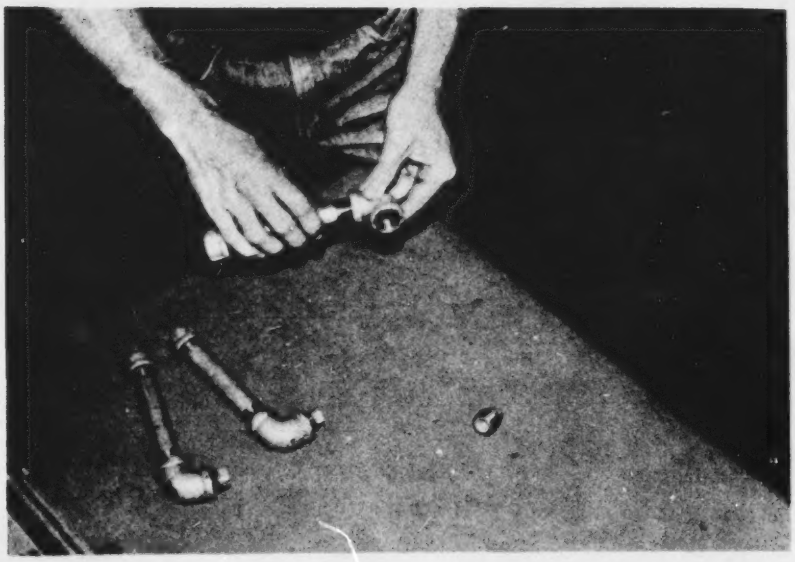


Figure 3.

Task 6

Given three each of ½" × 5" nipples, ½" plugs, and ½" caps, the student will assemble three duplicates of the pipe assembly which was assembled by the evaluator. **Note Time!**

Preliminary Exercise:

The evaluator will demonstrate the use of ½" unions with ½" × 3" nipples. Put the two union ends on the nipples first, then join the union. (See Figure 4.)

Special Instructions: *The three union components and 3" nipples should be placed in separate but adjacent groups. Instruct the student that the two union end-pieces should be connected to the nipples prior to joining the union.*

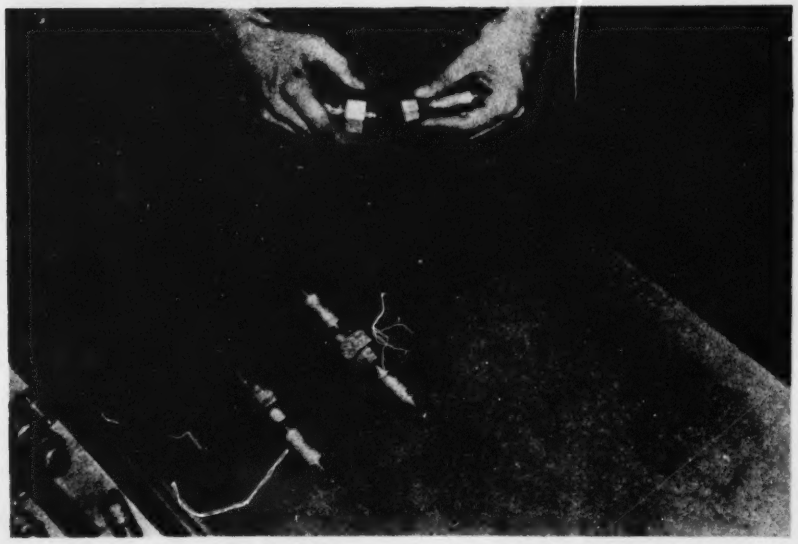


Figure 4.

Task 7

Given three ½" × 3" nipples, the student will assemble three duplicates of the pipe assembly which was assembled by the evaluator. **Note Time!**

Preliminary Exercise:

The evaluator will demonstrate the use of 10" and 14" pipe wrenches to tighten a union joint with 3" nipples attached. (See Figure 5.)

Special Instructions: Use one set of components to demonstrate and another for the task. Instruct students not to place wrench on pipe threads.

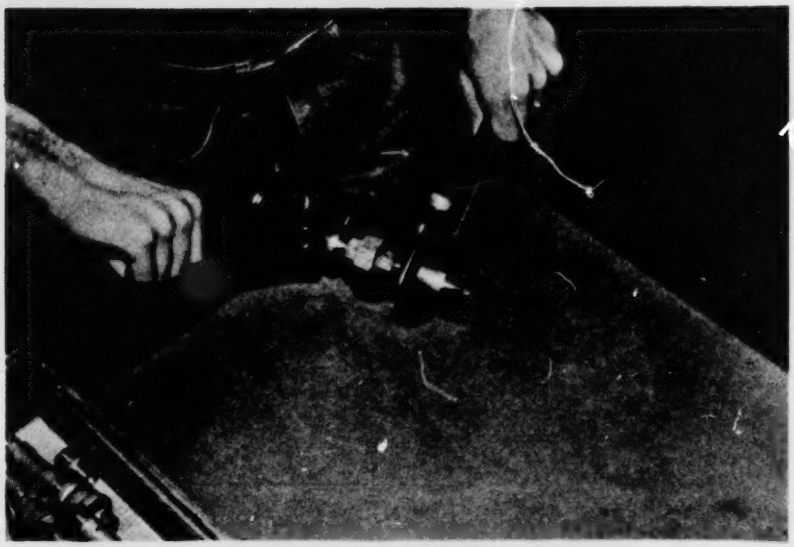


Figure 5.

Task 8

Given a ½" union joint, two ½" × 3" nipples, and two pipe wrenches—10" and 14", respectively, the student will tighten the two nipple joints to the ends of the union and then connect and tighten the union. **Note Time!**

Preliminary Exercise:

The evaluator will demonstrate how to assemble plumbing components as illustrated. (See Figure 6.)

Special Instructions: *Have pipes assembled and let student see them and observe you taking them apart. Leave components mixed and let student use Figure 6 to assemble the pipes. At the completion of this task, the evaluator and student should take a short break to remove oil from their hands, etc.*

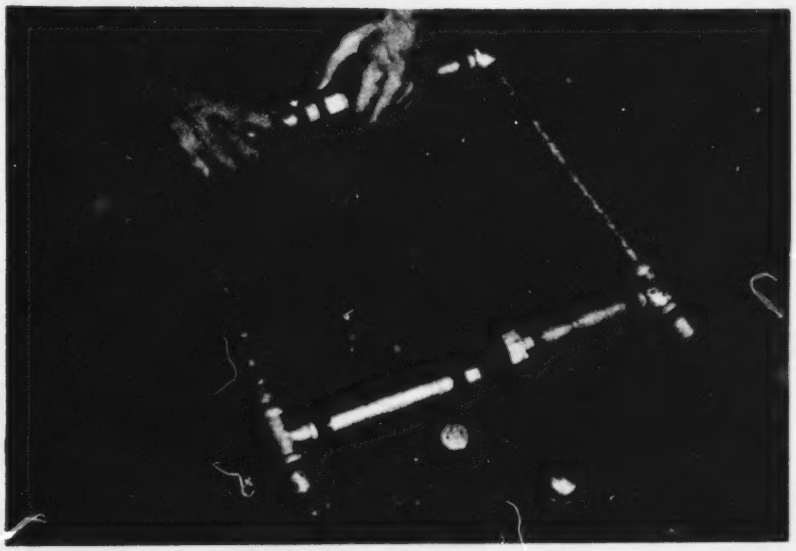


Figure 6.

Task 9

Given two each of ½" × 12" nipples, ½" × 6" nipples, ½" × 5" nipples, ½" × 2" nipples, ½" elbows, ½" unions, ½" tees, and ½" caps, the student will duplicate the pipe assembly depicted in Figure 6. **Note Time!**

Preliminary Exercise:

The evaluator will identify the tubing cutter and demonstrate its use with ⅜" copper tubing. (See Figure 7.)

Special Instructions: *Instruct student to place tubing on the two rollers and to tighten the cutter with each turn. Use a long length of tubing as short lengths tend to slip while in the student's hand.*

Figure 7.

Task 10

Given a tubing cutter and ⅜" copper tubing, the student will cut off two 6" pieces of the tubing. **Note Time!**

Preliminary Exercise:

The evaluator will identify the flaring tool and demonstrate its use in flaring ⅜" copper tubing. (See Figure 8.)

Special Instructions: *Instruct the student to be certain tool is turned and locked and to turn handle several times (loosen and tighten). Instruct the student to put tubing end ⅛" out from edge of locking device.*

Figure 8.

Task 11

Given a flaring tool and the two 6" lengths of ⅜" copper tubing, the student will flare one end of each tube. **Note Time!**

Preliminary Exercise:

The evaluator will demonstrate the use of adjustable wrenches and brass fittings with ⅜" copper tubing. (See Figure 9.)

Special Instructions: The 6" adjustable wrench is to be used on the small fittings, and the 10" adjustable wrench on the union. Use the lengths of tubing which were flared in Task #11.

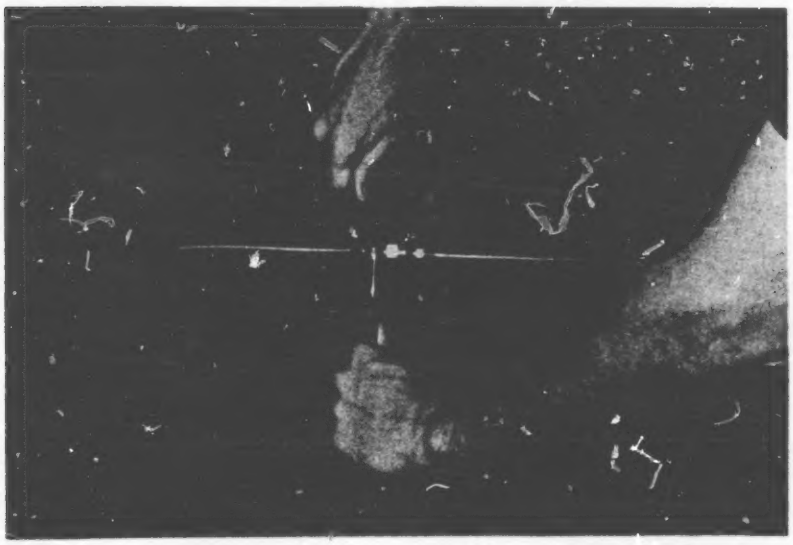


Figure 9.

Task 12

Given a 6" and 10" adjustable wrench, two lengths of flared copper tubing and a quantity of brass fittings, the student will assemble the tubing and fittings as demonstrated by the evaluator. **Note Time!**

Preliminary Exercise:

The evaluator will identify a ½" × 12" section of PVC pipe and demonstrate how to clean the pipe, apply cement, and join the pipe to a ½" PVC coupling. (See Figure 10.)

Figure 10.

Task 13

Given a ½" × 12" section of PVC pipe, a can of PVC cleaner, PVC cement, and a ½" coupling, the student will clean the pipe, apply the cement and join the pipe and coupling as demonstrated by the evaluator. **Note time!**

VOCATIONAL EDUCATION READINESS TEST (VERT)
SCORING RESULTS SHEET FOR PLUMBING

(Example Only)

Name _____

Student Performance Data

	Time*				
	Acceptable	Unacceptable	**Cut-Off Time (Seconds)		
Task 1	_____	_____	(1/2")	X	Measure-ment Skills
Task 2	_____	_____	(1/4")	X	
Task 3	_____	_____	(1/8")	X	
Task 4	_____	_____	(1/16")	X	
Task 5	_____	_____	55		
Task 6	_____	_____	70		
Task 7	_____	_____	150		
Task 8	_____	_____	350		
Task 9	_____	_____	2500		
Task 10	_____	_____	385		
Task 11	_____	_____	360		
Task 12	_____	_____	245		
Task 13	_____	_____	115		

*Write N/C should student be unable to complete the task.
**These scores were arbitrarily identified and included for demonstration purposes only.

Plumbing Vocabulary

AIR TEST: Pumping air into newly laid plumbing to a pressure of 100 pounds per square inch and checking it 24 hours later for possible leaks.

BATHROOM FIXTURES: Includes the bathtub/shower combination, lavatory, and toilet.

BLOW-OUT TOILET: A toilet operated with flush valves only--usually installed in schools, offices and public buildings due to its economy features.

BORED WELL: A shallow well made by boring a hole in the earth with a hand or machine-driven auger.

CALKING PIPE: Placing oakum and lead in cast-iron pipe joints to seal and prevent leaks.

CAST-IRON PIPE: Standard iron pipe dipped into asphalt to help prevent corrosion.

CESSPOOL: A hole in the ground into which raw sewage is dumped without treatment--a health problem!

COCK VALVE: A device used for shutting off the flow of water in a line.

DISPOSAL FIELD: A sewage disposal system consisting of a septic tank, distribution box, sealed discharge lines and the required length of disposal tile lines.

DRAIN COCK: May be called a waste cock--is used to drain a line in which the water is shut off.

FAUCET: Device used to control the flow of water--when the faucet's handle is turned, it presses a washer valve against a valve seat.

FLANGE FITTING: A pipe fitting (cast-iron disks) used to close pipes with protruding edges (flanges).

FLOAT: A device used for controlling the water level in the flush tank of a toilet.

FLUSH VALVE: A rubber ball and seat located at the bottom of a flush tank.

GRAVITY WATER SYSTEM: An older type water supply system where water is pumped and stored in a tank above the house and flows to the house by gravity.

GREASE TRAP: A small tank connected to the sewer line to trap grease before it enters the main sewer line.

HOUSE DRAIN: A large pipe, usually underground, which discharges all of the sewage in the house into the street sewage line.

LAVATORY: A bowl or basin used for washing--made from steel, cast iron, china, or plastic.

LEAD: A soft, workable metal with a low melting point--used to make clean tight joints in drain pipes.

NIPPLE: A piece of pipe less than 12 inches long threaded on both ends.

NONCORROSIVE PIPE: A pipe, which is not affected by oxidation, chemicals, etc. This includes duriron, plastic and glass pipes.

OAKUM: A rope-like or hemp fiber used to pack the socket joints of drainage pipes.

PERCOLATION TEST: To test the soil and determine its water absorption properties.

PLASTIC PIPE: A pipe manufactured from plastic with sizes ranging from ½ to 6 inches in diameter.

PIPE REDUCERS: Couplings used to reduce the inside diameter of a run of pipe.

SEPTIC TANK: A waste disposal system that will break down animal and plant waste matter by using bacteria and fermentation. Solid waste settles to the bottom and the remaining liquid flows into the disposal field and is absorbed by the soil.

SEWER CLEANOUT: Openings at the bends or "elbows" of pipes to permit cleanout tapes or rods to be inserted to remove clogs.

SEWER SLOPE: House sewer pipe should have a slope (fall) of 1 inch in 4 feet to prevent the solid waste from clogging the line.

SOIL STACK: Pipe which drains toilets in multi-storied buildings. A vertical pipe connecting to the building's main sewer line at the bottom and open to the air on the roof.

TEES: A pipe coupling with three outlets used for connecting a branch line to a main pipe.

TOILET: Sometimes called a water closet; is the most important of all sanitary fixtures. It carries off human waste and is self-cleaning, sanitary, and noiseless in operation.

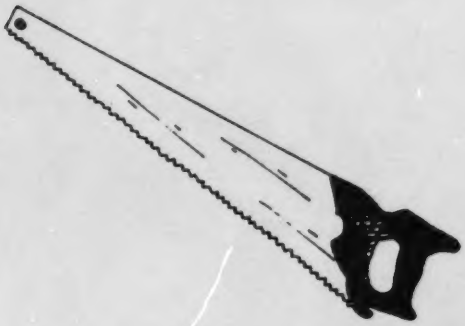
TRAPS: S-shaped traps are used in lavatorys, bathtubs, toilets, etc. to allow water to flow into the sewer drains and at the same time prevent sewer gas, odors, etc. from entering the room.

UNIONS: Pipe couplings used to join two pipes--used when it is desirable to quickly disconnect or connect two pipes in an existing water supply system.

VENT: The part of a sewage system which provides for the circulation of air to and from any part of the sewer system.

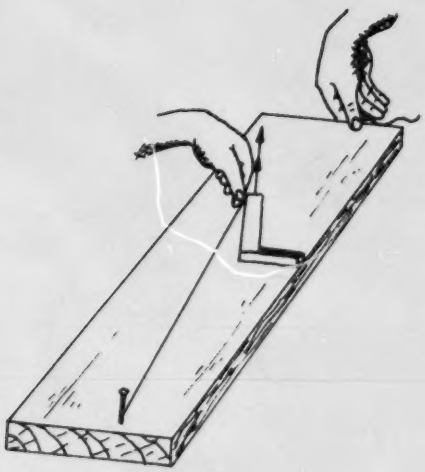
WELL: A hole drilled into the ground to obtain water.

Tools for Plumbing



HANDSAW

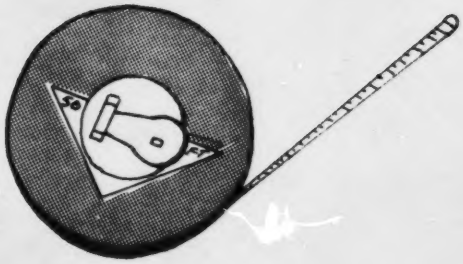
PIPE CUTTER



CHALK LINE

SCRIBER

BALL-PEEN HAMMER

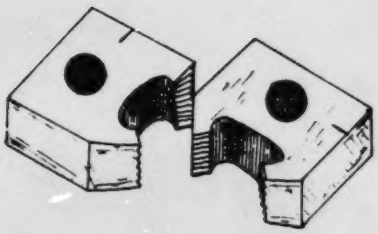


STEEL MEASURING TAPE

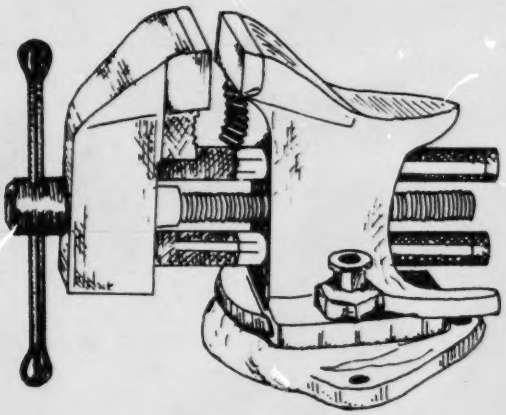
STRAIGHT EDGE

PLUMB BOB

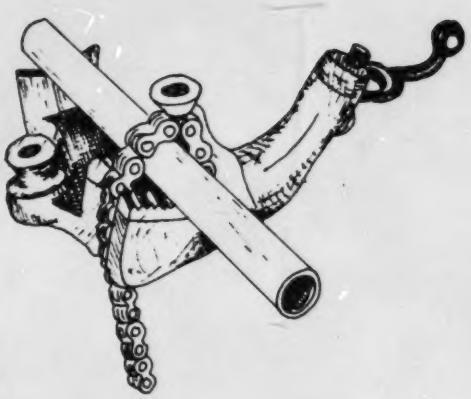
20



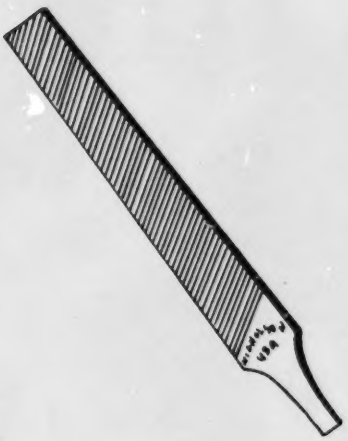
PIPE THREADING DIE



BENCH VISE

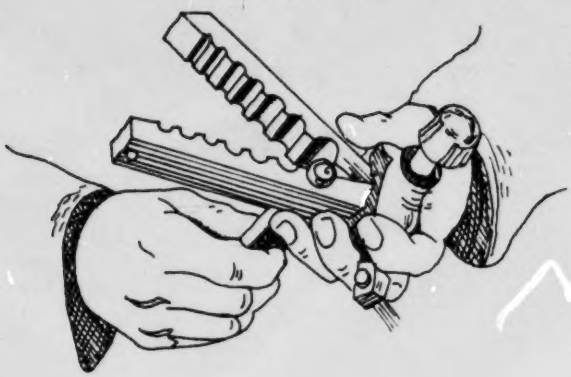


PIPE VISE

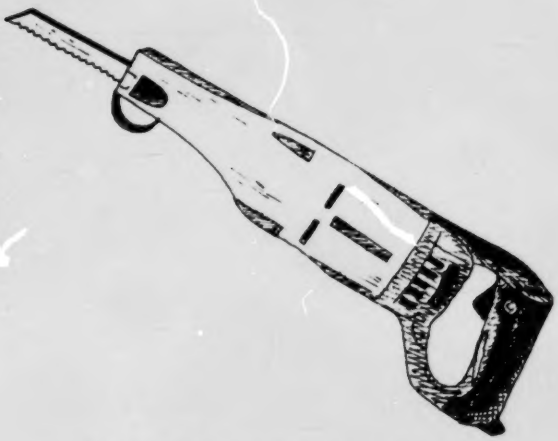


METAL FILE

21



FLARING TOOL



POWER HACKSAW

SCRATCH AWL

WOOD RASP

22

TRY SQUARE

AUGER BIT

BLOW TORCH

WOOD CHISEL

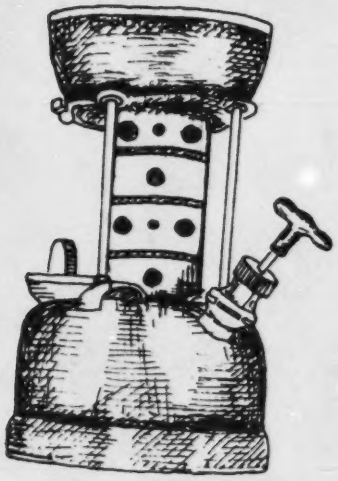
23

PIPE TAP

PIPE REAMER

TWIST DRILL

PIPE WRENCH (STILSON)

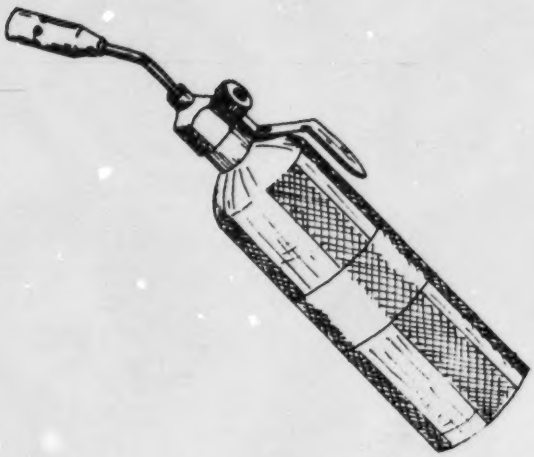


SOLDERING IRON FURNACE

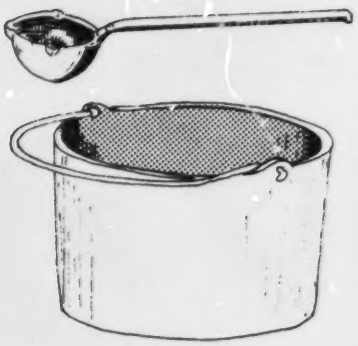
RATCHET BRACE

STRAP WRENCH

LINE LEVEL



PROPANE TORCH



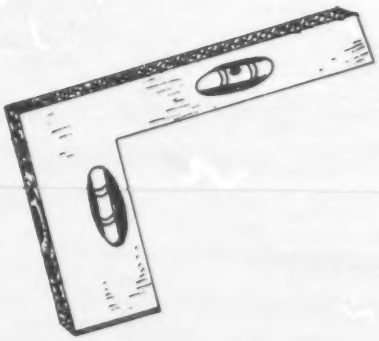
MELTING POT AND LADLE

CLAW HAMMER

RATCHET SCREWDRIVER

26

CENTER PUNCH

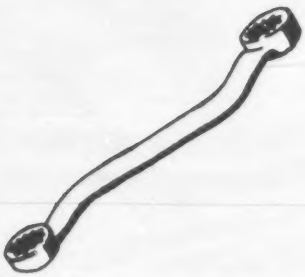


CROSS AND TEST
LEVEL AND PLUMB

ADJUSTABLE WRENCH

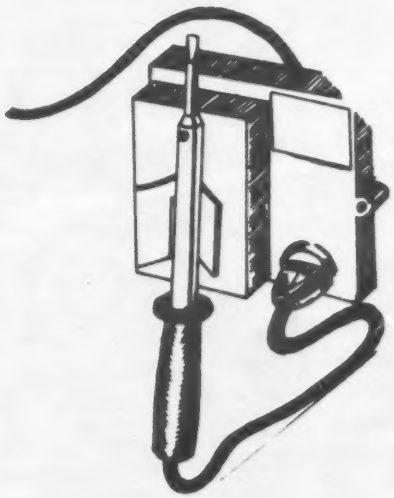
ALLEN WRENCH

OPEN-END WRENCH



BOX-END WRENCH

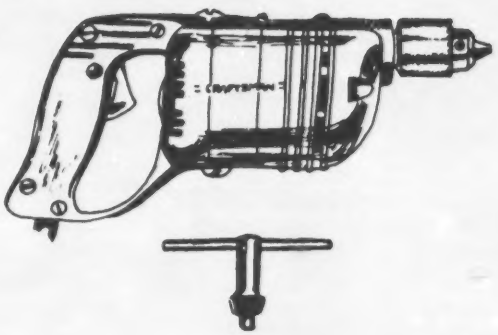
1 INCH SOCKET



ELECTRIC
SOLDERING IRON

FLATBLADE SCREWDRIVER

PHILLIPS SCREWDRIVER



ELECTRIC POWER DRILL

COMPUTATIONAL SKILLS
FOR
Plumbing

Addition:

1 1/3	2 3/4	4 7/8	5 1/2	3 1/2	19 7/16	46 1/8
+2 2/3	3 1/2	6 7/8	6 1/4	9 1/2	17 3/16	55 3/8

						56
123	2,320	12.88	1.67	.06	.92	43
56	199	11.22	.09	.07	.09	7
						19

132		
88	1/2	11 5/16
11	3/4	6 1/4
121	1/3	3 3/8

Subtraction:

18	10.3	11 1/2	8 3/8	22 3/4	13 11/16
-7	6.8	3 1/4	4 5/8	6 1/2	2 3/16

1/67	.92	23.04	16.50	112.62	110.17
.09	.09	3.97	8.51	99.73	109.79

Multiplication:

15 × 3=	2.3 ×6.8 =	1/4 × 1/2 =
22 × 22=	9.9 × 13.4 =	8 × 9.5 =
11 × 110 =	11.5 × 16 =	12 × 11 =

Division:

4 ÷ 2 =	129.6 ÷ 10 =	25.5 ÷ 5 =
16 ÷ 2 =	44 ÷ 12 =	25.5 ÷ 15 =
36 ÷ 6 =	116 ÷ 36 =	1080 ÷ 33 =

Reading Problems

1. Four inch drain pipe (lightweight) cost $7.00 per 20 foot joint. How much will 7 joints cost?
2. A building supply store will give you a 10 cents on the dollar (10 percent) discount on all plumbing supplies. You purchase $85.00 in plumbing supplies. How much discount will you receive?
3. "K" copper tubing (½ inch) is 75 cents per foot. PVC plastic pipe (½ inch) is $2.15 for a 20 foot joint.
   a. How much will you pay for enough copper tubing to run a water line 10 feet?
   b. How much will you pay for enough PVC pipe to run a water line 110 feet?
   c. How much cheaper is the PVC pipe than the copper pipe for the 110 foot line?
   d. Labor charges for digging (opening) the line will be approximately 75 cents per foot. A friend offers to dig the line for $95.00. Is this a bargain? Why?

4. You plan to do a simple plumbing job and you need the following supplies:

   3 ½ inch PVC tees at 29 cents each
   3 ½ inch PVC elbows (90°) at 28 cents each
   1 can of PVC cleaner at $1.30 each
   1 can of PVC cement at $1.80 each
   1 joint of PVC pipe (½ inch) at $2.15 per joint
   2 ½ inch female couplings at 19 cents each

   How much will your supplies cost?

5. Your service charge for labor is $8.00 per hour Monday through Friday from 8:00 a.m. until 5:00 p.m. You receive $10.00 per hour for all other calls.

   a. You worked for Mr. Jones from 2:00 p.m. until 5:00 p.m. on Wednesday. How much money did Mr. Jones owe you?

   b. You worked for Mrs. Simpson from 6:00 p.m. until 10:00 p.m. Thursday night. How much money did Mrs. Simpson owe you?

   c. You worked 8 hours on Saturday for Acme Construction company. How much money did Acme owe you?

   d. How much money did you make on the three jobs?